THE EXTINCT CUTTLE-FISH IN THE CANADIAN NORTH-WEST.

A PAPER READ BEFORE THE CANADIAN INSTITUTE, TORONTO, MARCH 14TH, 1885.

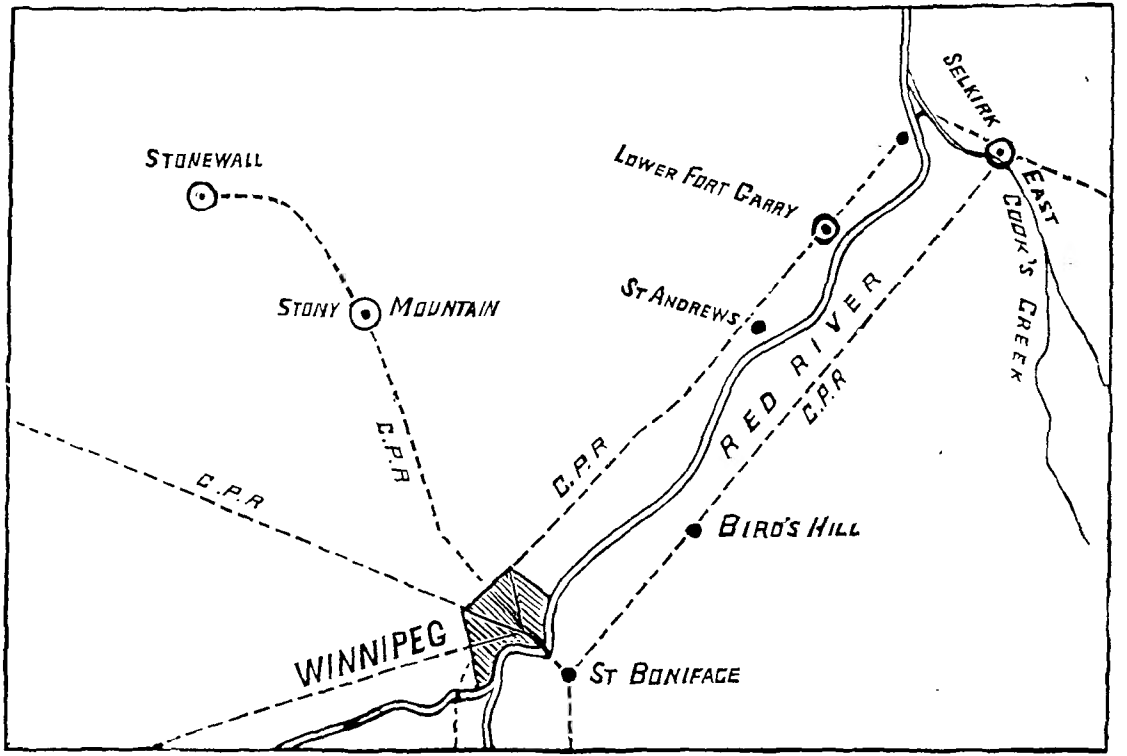
BY

A. McCHARLES.

"Geology gives one the same idea of time as the stars do of space."—CARLYLE.

Toronto:
PRINTED BY HUNTER, ROSE & CO.
1885

THE WINNIPEG DISTRICT.



SCALE, SIX MILES TO THE INCH.

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THE

EXTINCT CUTTLE-FISH

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MR. PRESIDENT, LADIES AND GENTLEMEN :—

I have chosen the Cuttle-fish as the subject of this paper, simply because it is the highest type of fossil life that I have found in the rocks of the Red River valley. It belongs to the fifth or second-last sub-division of the animal kingdom, and is in its structure the most highly organized of all the invertebrates. I may also state that it had a wide geographical distribution in its day, its fossil remains having been found in various parts of the world, and many different species of it. But all the ancient forms are extinct now, and the Pearly Nautilus is the only living representative of this great family at the present time, which does not favour the theory of evolution, as far as the Cuttle-fish is concerned at all events.

But the new field for geological research lately opened up in the North-west by the building of the Canadian Pacific Railway is so large that a single paper can only deal superficially with a very small portion of it, and as I heard a distinguished member of the British Association remark last year, after traversing it on the train, all future reputations in this department of science in Canada must be made there. From Lake of the Woods to the Rocky Mountains the distance is over 900 miles in a direct line, and we pass at the same time from the Laurentian or oldest rocks on the east almost to the summit of the geological series in the west. This vast territory, however, is not a uniformly level plain, as the most of people who have never been over it still imagine, but a succession of three great prairie steppes, rising one above the other from east to west, and with a marked difference in their physical features. The ascent, of course, is irregular, and to the ordinary traveller imperceptible, but from Winnipeg to Calgary it averages over four feet a mile the whole way.

The Red River valley constitutes

THE FIRST PRAIRIE STEPPE,

and is a fine alluvial district, gently undulating in long sweeps, but rather flat in some places to be properly cultivated without drainage. It is about 50 miles wide at the international line between Canada and the United States, and expands a good deal towards the north, with a general elevation of 800 feet above the sea. It comprises an area of 7,000 square miles, or nearly 4,500,000 acres of the best land in the world, and mostly open prairie ready for the plough, with sufficient timber for the settlers' needs along the rivers and their tributary streams; such as oak, elm, poplar, the beautiful ash-leafed maple and other native species. But the river beds on this steppe are of recent formation and merely cut through the modified drift, with steep clayey sides and muddy bottoms, and not more than thirty to forty feet deep at any point.

THE SECOND PRAIRIE STEPPE

is much larger, being about 300 miles wide at the American boundary—though somewhat narrower to the north—and contains an area of 60,000 square miles, or nearly 40,000,000 acres of fine rolling land, admirably fitted for agricultural purposes. It commences on the east where the railway crosses it at Carberry station, and extends to Moosejaw, with an average height of 1,600 feet above the sea. The river valleys on this steppe are usually from 100 to 200 feet deep, with sloping, grassy banks, and evidently far older than the streams that flow through them now.

THE THIRD PRAIRIE STEPPE

is still larger and higher, being over 450 miles wide at the forty-ninth parallel and fully 3,000 feet above the sea. It covers an area of 140,000 square miles, or 90,000,000 acres in round numbers, and stretches from Moosejaw to the Rocky Mountains. In other words, it is equal in extent to the settled parts of all the other provinces of the Dominion put together. This enormous plateau is better adapted for stock raising, and the principal coal fields of the North-west are also found there. So that it is capable of producing an unlimited supply of excellent beef as well as the fuel to cook it with—not a bad place, by the way, for people to go to these hard times. The river valleys on this steppe are from 250 to 500 feet deep, cutting entirely through the drift and into the underlying Tertiary and Cretaceous rocks.

NORTH-WEST COAL.

I may say here that the Saskatchewan coal, as it is called, has turned out to be of much better quality than anyone had ever expected until very recently, and it improves right along as the mine is worked beyond the weathered surface of the seam. It contains from 60 to 70 per cent. of fixed carbon, kindles readily, sends out intense heat, leaves no clinkers, and gives entire satisfaction to consumers. Four years ago I paid as high as $22 50 a ton for imported Anthracite in Winnipeg, but bought

native coal there last fall at $7 50 a ton, and the economic difference between them is only about 30 per cent. It will therefore be seen that the fuel question, which was thought to be such a great drawback to the country in the past, has virtually been solved at the very start, and even an export trade in coal has already commenced with Dakota and Northern Minnesota, in spite of the high duty imposed by the American Government, as neither of these States has any workable coal beds of its own.

THE RECORDS OF THE ROCKS.

With these preliminary remarks of a general nature, I now wish to direct your attention for a short time to the geology of the Red River valley or first prairie steppe. The surface or ordinary soil is a rich black loam, from one to six feet deep, and exceedingly fertile. The intervening deposits between it and the fundamental rocks—as I have been able to ascertain from an intelligent contractor who has been engaged for the past five years in boring Artesian wells in Winnipeg—vary in thickness from nothing to ninety feet, and they are generally arranged in the following order :—

1. Light drab clay, but more frequently yellowish sandy clay, three to six feet.
2. Dark blue clay, with boulders of various kinds scattered through it, but mostly gneissoid, twenty to fifty feet.
3. Hard pan, one to ten feet.
4. Boulders, gravel and sand, five to thirty feet.
5. Broken limestone similar to the bed rock immediately below it, two to four feet.

The average depth of these deposits in the Winnipeg district is about sixty-five feet, but fortunately there are a few natural outcrops and several quarry exposures, where the rocks can be seen and studied to advantage, notably at Stonewall, Stony Mountain, Lower Fort Garry and Selkirk East. They are all situated on a line about twenty miles in length, and running almost east and west.

STONEWALL.

The first outcrop I visited is at Stonewall, eighteen miles north-west of Winnipeg, on a branch of the Canadian Pacific Railway. The town is built on a gravel ridge somewhat resembling a lateral moraine, and in many cases the cellars of the houses have been dug to the solid rock, about seven feet below the surface. The finest example of glacial action I have ever seen is on the floor of Mr. S. J. Jackson's cellar there, and a little incident that occurred while I was examining it gave me perhaps a better view of it than I otherwise would have got. My female guide happened to upset a pitcher of milk at the foot of the stair, which ran down in a dozen streamlets in the deep grooves of the rock to the other side of the cellar. But the striæ indicate a south-easterly trend there, as at all other points in the Red River valley, while less than 100 miles to the east, at Lake of the Woods, the course of the glacier was south-

westerly, as over the greater part of the continent. It is worthy of note, too, in this connection, as any one can see by a single glance at the map of Manitoba, that the general direction of the hills and mountains which form the western escarpment of the valley, and of the three great lakes to the north, is south-easterly, and the gravel ridges usually follow similar lines.

The Stonewall bed, as shown at Major Bowle's quarry, near the station, where a large exposure has been made, is a coarse-grained dolomite apparently of the Niagara formation, very finely stratified into layers of nine inches to two feet in thickness, and regularly jointed at right angles. The stone is of a light gray colour, weathering to opaque white, and makes, when burned, what plasterers call "finishing lime," but it is considered too hard and heavy for ordinary building purposes, and is chiefly used in the construction of railway bridges, for which it is said to be peculiarly suitable. Cold acid has no effect upon it, but when the acid is heated it effervesces freely.

A few layers near the surface of the quarry have a honey-comb band running horizontally through them, which looks very much like a compressed bed of fossils, but as might be supposed from the indurated character of the rock very few distinct traces of animal life are to be seen in it, and I was only able to find some fucoids, or petrified sea-weeds, and one specimen of *Receptaculites occidentalis* there.

STONY MOUNTAIN.

The next point of special interest to the geologist in the Winnipeg district is Stony Mountain, 12 miles almost due north of the city, and six miles south-east of Stonewall, on the same branch of the railway. The so-called mountain is shaped like a mammoth horse shoe, one mile wide from east to west, and two miles long from north to south, but rising only about sixty feet above the surrounding prairie, with precipitous rocky bluffs on the north and west sides, and running out into gravel ridges towards the south on both arms. Its surface is partly covered with clumps of trees, and thickly strewn with boulders of limestone, gneiss and granite.

The cliffs and other outcrops on the mountain afford the amplest facilities for investigation, but the bed can be seen and examined more satisfactorily at Macalister's quarry there, on the west side, where a fine exposure has been made, about 20 feet deep, and one hundred yards in length, facing the south, with a lateral ravine in front of it. The rock is magnesian limestone, also of the Niagara formation, very compact, and stratified as at Stonewall, but of a light yellow colour, weathering to rusty red, and when burned it produces a very strong lime, well adapted for making mortar, but scarcely white enough for plasterers' use. You will thus notice three points of contrast between the two outcrops, though only a few miles apart and belonging to the same geological horizon; namely, in the colour of the stone, the different quality of lime it makes, and the effect of the weather upon it.

The bed at the quarry is covered with six to ten feet of loose gravel

in which the pebbles are smooth and rounded, but when bared the surface of the rock shows unmistakably that the glacier ground over it, the striæ, as already stated, indicating a south-easterly trend in every case.

But the organic remains of this outcrop are likewise rather meagre for obvious reasons. I succeeded, however, in getting some beautiful specimens of *Columnaria alveolata*, or honey comb coral there, as well as the fragments of an *Orthoceratite*, or the first Cuttle-fish I came across in the North-west, and a rare species of *Beatricea*, probably *B. nodulosa*. It is 12½ inches long, nearly circular, and tapers irregularly from 2¾ inches in diameter at the larger end to 1⅞ inches at the other. The siphuncle is placed slightly on one side, and the surface thickly studded with conical tubercles, about ⅛ inch in diameter at the base, and five lines in length, running around it obliquely in parallel rows, many of them with a small pit or depression in the centre.

On the same side of the mountain, about two furlongs south of Macalister's quarry, a deep well was put down some years ago for the Manitoba Penitentiary, which is located there, and after passing through 40 feet of solid rock, the same in every respect as at the quarry, and then through 10 feet of clay and shales, another bed of limestone was struck, of a purple colour, and uncommonly fossiliferous. In fact, the pile of debris of this lower deposit, thrown out of the well, is literally one mass of Bivalve shells, mainly of the Hudson River formation, and wonderfully well preserved; such as *Rhynchonella capax*, *Orthis subquadranta*, *O. testudinaria*, *Strophomena alternata* and *S. nitens*, with many fossil snails and a few corals and encrinites. I secured altogether twenty-three different species there, (the names of which are given in a subjoined list), among them my particular favourite, the Cuttle-fish and a peculiar *Zaphrentis* or horn coral, with three lobes, which I have never met anywhere else. The stone in the lower bed will readily dissolve in cold acid, but in the upper bed only when the acid is heated.

LOWER FORT GARRY.

We shall now return to Winnipeg, and then follow the Red River to Lower Fort Garry, eighteen miles north-east of the city, but not on foot as I went last summer, which was no constitutional walk, I can assure you, with so many ravines, sloughs and coulees to cross, and the thermometer over 90° in the shade. And yet geological field work in the North-west is mere amusement as compared with the arduous labours of Sir William Logan and his staff in the densely wooded districts of the eastern provinces. The banks of the river bed are quite abrupt the most of the way, and a few feet from the surface, fresh water shells occur in great numbers, often in bands of considerable length, but so frail that they crumble on being handled; such as *Natica clausa*, *Astarte borealis* and *Saxicava rugosa*. I saw nothing else worth noting till I reached St. Andrew's, fourteen miles from Winnipeg, where the rapids begin, and a little farther on the river rushes over a rough ledge with a fall of two to three feet, but the rock being wholly under water then, owing to the June rains, I was unable to examine it. The banks

become more sloping for the next few miles, and the beach shingly, or covered with boulders, gravel and sand.

I was getting rather tired by this time, and wished to hire one of the half-breeds, who are very numerous there, to take me over the rapids and down to the fort in a birch bark canoe. They were loafing idly around their log-huts, or lying under the trees by the road-side, but I could not induce a solitary man of them to go with me for any consideration until I produced a flask of genuine Scotch whiskey I had in my lunch-pail, and promised to divide it honorably at the other end of the run. It had the desired effect; for the natives of the North-west are easily interested in palæontology of that kind, if I may use such a cheap pun. They all wanted to go then, and choosing an active young fellow, I am fully convinced that even Hanlan would have envied the fast record we made!

On landing at Lower Fort Garry I found several out-crops on the west bank of the river, and a quarry has been opened there. But this bed is somewhat peculiar in one respect. The rock in the upper three or four layers is hard, or "flinty," as the stone masons term it, and with comparatively few traces of animal life in it, but resting closely and conformably on softer strata full of fossil remains. Indeed this subjacent bed is composed to a great extent of *Columnopora cribriformis*, associated with *Columnaria alveolata*, and various other kinds of coral in a fine sub-crystalline state. It also holds numerous groups of trilobites, but only fragments of them are preserved as a rule. To be brief, I procured no less than twenty-five different species at this prolific spot, including a large Cuttle-fish, twenty-seven inches long, and three and a-half inches in diameter, with forty-two septal rings on it; but the quarry having been worked in winter, the over-hanging earth caved in when the frost came out in the spring, and I could not, therefore, examine it as thoroughly as I should like. The stone is of a mottled colour in which yellow and light grey are beautifully blended. It fractures with a wavy or corrugated surface, and cold acid acts upon it.

SELKIRK EAST.

This important point is 23 miles north-east of Winnipeg, on the main line of the Canadian Pacific Railway, and about two miles east of the Red River. It was intended at one time to be the metropolis of Manitoba, and being at the head of lake navigation, with natural drainage and other special advantages, a better site for a city could not easily be found; but only a straggling village marks it now, in which I failed to get decent lodgings last fall, and had to pass the night beside a burning lime kiln.

A few rods from the station a large mound over a mile in length, and running almost north and south, rises perhaps 30 to 40 feet above the general level of the land there. The rock does not protrude to the surface anywhere on the ridge, but Cook's Creek cuts through it near the middle, exposing the bed, and some fine fossils have been found along this stream. One huge Cuttle-fish, particularly, is the most perfect

specimen of *Orthoceras tenuiseptum* I have ever seen. It is weathered into high relief on a thick slab, and so well preserved that a dog, on coming into the rooms of the Historical Society of Winnipeg one day last summer, and seeing it on the window sill with the sun glinting upon it, made a sudden snatch at it, no doubt mistaking it for a *bona fide* fish!

But my investigations were confined mainly to Bannatyne's quarry near the south end of the mound. This exposure presents a good many new features of an interesting nature. Unlike all the other outcrops I have visited in the Red River valley the rock is not in a horizontal attitude, but thrown out of position, and generally inclined at an angle of 30 degrees to the west. On one side immense blocks are tilted in every direction, but the regenerated drift, which caps the ridge, so far from being disturbed, is clearly stratified not only near the surface, but also in the angles between the fragmentary rocks, in some places to the depth of 15 to 20 feet, which may possibly indicate that the upheaval took place before the glacial period. I have not seen any striæ at Selkirk, but the limestone field boulders there make the very same lime as the Stonewall bed 20 miles to the west, which is probably the parent rock they were transported from; and this fact is further proof of the south-easterly course of the glacier in the Red River valley, as there is no known bed of limestone like them to the north-east from which they could have come.

Then the stone in this outcrop is quite soft, and being easily dressed, it is largely used by builders all over the Province for ornamental stone work. It splits readily, almost like wood; which prevents waste, and takes a very fine polish. I have even seen some handsome monuments made of it. Colour, pale gray mottled with brown spots, and being exceptionally free from iron or other oxydes, it does not tarnish by exposure to the weather, as the most of limestones do, but rather turns a shade lighter, if any. It effervesces violently in cold acid. The bed, however, is not well stratified, but as a rule two or more layers are cemented together by a yellow band of what the quarrymen call "dry stone," and when parted on these lines it exhibits a rough nodulous surface. The ripple ridges, which occur very closely and irregularly in the majority of cases, may mean that this deposit was made in shallow water along the margin of the Lower Silurian sea, overlapping the great Laurentian series, and not at the mouth of a river, or in a current running constantly in one way.

I may say *en passant* that Winnipeg is more fortunate than the most of cities in having an inexhaustible supply of the best building stone in the world so near it, and any amount of excellent brick clay all around it. The largest hotel there, a five storey block, was built of brick made on the ground from the excavations of its own cellar.

But the extraordinary feature of the Selkirk bed is the enormous number, variety and size of the fossils to be found in it. I have collected from a small part of the stone quarried there last summer nearly fifty different species, and over five hundred specimens. Of the corals *Stromatopora* is the most common. It runs in great nodules and

patches throughout the whole bed, accompanied by *Receptaculites occidentalis*, which is very abundant there, in specimens of all sizes from three to fifteen inches in diameter, but always in the shape of an umbilicated disc, and *Halysites catenulatus* in any quantity, as well as *Streptelasma corniculum*, of which on general principles I have found four distinct forms.

The first is cylindrical, nearly straight for three-fourths its length, with a sharp curve at the point.

The second is more or less triangular, and uniformly curved.

The third is oval, curved moderately the whole way, with an acute edge on the anterior side.

The fourth is short, almost straight, and expanding widely at the cup.

As for the Cuttle-fish, hardly a stone of any size is taken out of the quarry in which one or more may not be seen, and I obtained about a dozen species of it in this bed. But I am afraid it would be trespassing too much on your patience to refer to them all in detail, and I shall, therefore, only mention three uncommonly fine specimens of this group that I got there. The first is a large specimen of *Orthoceras tenuiseptum*, ten inches in diameter, and twenty-three inches long, with thirty-seven rings of growth on it; the second is a magnificent specimen of *Endoceras subannulatum* with the test or shell unusually well preserved and very finely ribbed; and the third is a gigantic specimen apparently of *Ormoceras Simpsoni*, of which the mere fragment I secured is over three feet in length.

But of all the fossils I have ever found there the best is a fine *Lituites undatus*, if this is its proper name. I am informed, however, on the best authority in Canada that it is probably a good new species which I earnestly hope may be true. The whole shell is ten inches in diameter, and at the aperture four inches, with three volutions, and the surface marked with transverse striæ. The septal rings are well defined, but the siphuncle is not shown. I also got a great many *Maclureas* in this outcrop, one of them a remarkably large specimen, which deserves special notice. It is over nine inches in diameter, and the cup three and a-half inches deep, with six distinct whorls, and the shell fairly preserved on the flat side. Other snails are very numerous too, and I came across a species of *Helicotoma* there that was never found before in the North-west, I am told. But Brachiopods and Crustaceans are both scarce, and complete specimens of either equally hard to get, though separate parts of trilobites are often seen, and I had the good luck to find a splendid *Asaphus platycephalus*, with curious spine-like processes on its dorsal side, which may determine it as well to be an entirely new type.

You will no doubt have noticed that the fossil fauna of the Selkirk bed takes an unusually wide range, but the prevailing species belong mostly to the Trenton formation.

I saw no Graptolites nor the persistent Lingula in any of the rocks of the Red River valley, but I have reason to believe that I obtained a larger number of species and finer specimens there than any other private collector in the same field, and yet I hope this is not saying too much of one's self.

CONCLUSIONS.

As scientific facts without generalization are of little practical use or interest I may venture to say that it would appear from the foregoing data and other observations I have made there :

1.

That all the rock outcrops of the Winnipeg basin belong to the Lower and Middle formations of the Silurian age.

2.

That the overlying deposits were made at two distinct epochs, as indicated by the duplicate beds of boulders, gravel and clay.

3.

That the direction of the glacier in the Red River valley was south-easterly, or different from its general course over the rest of the northern hemisphere.

4.

That the primeval seas that covered the valley in the Silurian age literally teemed with various forms of marine life.

5.

That the fauna of each period was of a strikingly different character, only a few species being common to the whole series.

6.

That the lower formations are softer stone and more fossiliferous than the upper beds, though the life of the latter may have been obliterated on account of their metamorphic nature.

7.

That the valley was covered by a fresh water lake—and not by the sea—after the glacial period, as no marine shells are to be seen in the modified drift.

8.

And, of course, that the climate of the North-west was tropical or nearly so in the Silurian age. There may have been cyclones, but there were certainly no blizzards there then.

LIST OF FOSSILS.

N.B.—The names of several species have not been determined yet.

STONEWALL.

Palæophycus obscurus..... ....Billings.
Receptaculites occidentalis.. .....Salter.

STONY MOUNTAIN (Upper bed).

Columnaria alveolata ....Goldfuss.
Petraia corniculum.....Hall.
Beatricea nodulosa.....Billings.
B. ——— undulata .... "
Rhynchonella capax.....Conrad.
Orthoceras annulatum..... .....Hall.

STONY MOUNTAIN (Lower bed).

Chætetes lycoperdon ....Hall.
C.—— rugosa ... . "
Retepora incepta..... . "
Columnaria alveolata ... . Goldfuss.
Streptelasma corniculum ....Hall.
Schizocrinus nodosus... .... "
Zaphrentis (three-lobed) . . ..

Murchisonia bellicincta ....Hall.
Pleurotomaria ambigua..... "
P.—— umbilicata..... .... "
P.—— subconica .... "
P.—— Laurentina ....Billings.
P.—— Elora ..... "

Rhynchonella capax..... .....Conrad.
R.—— fringilla..... ..... Billings.
Orthis testudinaria..... .....Hall.
O.—— subquadranta .... "
O.—— occidentalis..... .... "
Strophomena alternata..... .... "
S.—— nitens .... "

Orthoceras recticameratum .....Hall
O.—— multicameratum ..... "
O.—— annulatum ..... "

LOWER FORT GARRY.

Stromatopora rugosa..... .....Hall.

Stromatopara undulata.... .....Hall
S.—— mammilata. .... "
Receptaculites occidentalis ..... Salter.
Halysites catenulatus ....Linnæus.
Columnaria alveolata .....Goldfuss.
Columnopora cribriformis. ....Hall.
Cyathophyllum Pennanti .....Billings.
Streptelasma corniculum .... Hall.
Petraia aperta ....Billings.
P.—— angulata .... "

Maclurea oceana ....Billings.
Murchisonia simulatrix . ... "

Ceraurus vigilans..... .....Hall.
Calymene Niagaraensis. ... . "
Bathyrus perspicator ....Billings.

Strophomena alternata ..... Hall.
Orthis borealis..... .....Billings.
O.—— testudinaria.... .... .Hall.
Spirifera —— ?..... .. . .

Orthoceras tenuiseptum..... ....Hall.
O.—— Lamarcki..... .... Billings.
Endoceras longissimum ..... Hall.
E.—— annulatum .... "
Ormoceras tenuifilum..... .... "

SELKIRK EAST.

Stromatopora concentrica .....Hall.
S.—— undulata.. ..... "
S.—— mammilata .... "
Receptaculites occidentalis .....Salter
Halysites catenulatus ....Linnæus.
Columnaria alveolata ....Goldfuss.
Columnopora cribriformis .....Hall.
Tetradium fibratum .....Safford.
Lyriocrinus dachylus .....Hall.
Streptelasma —— ? .....
S.—— —— ? ....
S.—— —— ? .....
S.—— —— ? ....

Lituites undatus ?..... .....Hall.
Maclurea matutina .... "
M.—— accuminata .... .Billings.
M.—— oceana .... "
M.—— magna ?..... ..... Hall.
Pleurotomaria umbilicata .... "

Pleurotomaria numeria.. ....Billings.
Murchisonia bellicincta ....Hall.
M.—— subfusiformis..... .... "
Subulites Psyche ....Billings.
Helicotoma planulata ?.....Salter.

Asaphus platycephalus ? ....Stokes.
Lichas Trentonensis ....Hall.
Cheirurus Polydorus..... .....Billings.
Ceraurus vigilans..... . .. .Hall.
C.—— pleurexanthemus..... ..... "
Illænus crassicanda . ... "
Amphion Westoni ? .. ..Billings.
Bathyurellus nitidus . ... "

Strophomena alternata..... .....Hall.
Rhynchonella Anticostiensis. ....Billings.
R.—— glacialis .... "
Orthis plicatella ....Conrad.
O.—— borealis..... ....Billings.
O.—— subquadranta .....Hall.

Cyrtoceras Isodorus ?..... .....Billings.
Phragmoceras Hector..... "
P.—— —— ? .....
Ormoceras tenuifilum..... .....Hall.
O.—— Richardsoni..... .....Stokes.
O.—— —— ? ....
Endoceras subannulatum ....Hall.
E.—— Longissimum . ... "
E.—— magniventrum. . . . . "
Orthoceras tereleforme ..... "
O.—— tenuiseptum..... "